284

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Agricultural Memorandum 1092.

COMPARISON OF RAINFALL DATA FROM SAWS, IN THE NORTH OF ENGLAND, WITH THAT FROM NEARBY GAUGES BETWEEN AUGUST 1986 AND JUNE 1987.

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INTRODUCTION.

It has been noticed that rainfall totals reported by synoptic automatic weather stations (SAWS) are often considerably different to reports from surrounding stations.
This memorandum reports comparisons of SAWS rainfall data with data from nearby sites in the Meteorological Office network.

DATA.

The sites used were:-

Keswick SAWS height= 77m, grid reference (35) 254 249 compared with:-

GAUGE NUMBER	HEIGHT (M)	GRID REFERENCE
593351	101	(35) 252 262
593521	76	(35) 246 243
593525	84	(35) 232 243
592717	76	(35) 267 218

Redesdale CARD height= 207m, grid reference (35) 824 991 compared with:-

GAUGE NUMBER	HEIGHT(M)	GRID REFERENCE
011070	235	(35) 834 955
011706	131	(35) 845 969
011384	162	(35) 937 932

Leconfield SAWS height= 6m, grid reference (54) 032 429 compared with:

GAUGE NUMBER	HEIGHT(M)	GRID REFERENCE
043681	2	(54) 072 483
041237	3	(54) 073 426
044703	6	(54) 049 342

FH2B

Warcop SAWS height= 244m, grid reference (35) 734 197 compared with:-

GAUGE NUMBER	HEIGHT(M)	GRID REFERENCE
598384	152	(35) 749 156
598690	176	(35) 722 195
598806	146	(35) 684 198

St. Bees Head SAWS height= 124m, grid reference (25) 956 148 compared with:-

GAUGE NUMBER	HEIGHT(M)	GRID REFERENCE
592199	94	(25) 941 143
591877	86	(25) 999 159

The annual average rainfall for each of these gauges are shown in appendix 1.
These sites were considered to be reasonably representative for use in a direct data comparison.

RESULTS.

Looking at monthly totals: over this long period the difference in the time of reporting (ie. SAWS 06-06 and the standard time of 09-09) is largely excluded.

i) Keswick.

This has proved to be the most unreliable of the SAWS. In many months the SAWS monthly total was over 50% higher than any other gauge total. Bearing in mind how close the gauges are to each other this does seem highly suspicious. The worst month was December 86 with the following totals:-

SAWS	593351	592717	593525	593521
690.6mm	334.2mm	374.7mm	419.7mm	348.0mm

Fig. 1 shows the accumulated totals for all of these gauges. It can be seen very readily that the totals reported by the SAWS are significantly higher than the four other rainfall stations.

ii) Redesdale CARD.

Redesdale gave a similar output to that of Keswick. Fig. 2 shows the much higher accumulated total than the three neighbouring gauges.

iii) Warcop SAWS, iv) Leconfield SAWS.

Both of these SAWS have accumulated totals that agree very well with the totals for their neighbouring rainfall stations. The individual months totals, however, seem to fluctuate being as much as +/- 30% different on a regular basis.

v) St. Bees Head.

The readings from St. Bees Head seem to be the most reliable of all of the SAWS in question. The monthly totals were within 25mm of the gauge totals throughout the period from August 86 to June 87. On the whole the differences were under 10%.

It was noted that the large differences in monthly totals were caused mainly by large differences in the daily values on days when heavy falls occurred. Examples of the daily values for Keswick and Redesdale are shown in fig. 3 and fig. 4. It was also discovered that the Warcop SAWS often missed falls completely. For example the reported rainfalls for 11th, 12th, 13th January 87 are shown below:-

DATE	SAWS	598384	598806
11/1/87	NIL	5.8mm	4.2mm
12/1/87	NIL	11.1mm	8.4mm
13/1/87	NIL	6.9mm	7.1mm

SUMMARY and CONCLUSION.

The SAWS at St. Bees Head compares favourably with reports from nearby rainfall stations as does the Leconfield SAWS. At Warcop the reports seem sensible but occassionally 'NIL' reports are sent when it obviously did rain. Keswick SAWS and Redesdale CARD appear unable to cope with heavy falls and their data seem very unreliable.

Figs. 3 and 4 show this unreliability and it can be seen by taking small groups of consecutive reports that the difference in reporting hours cannot explain the differences in daily totals.

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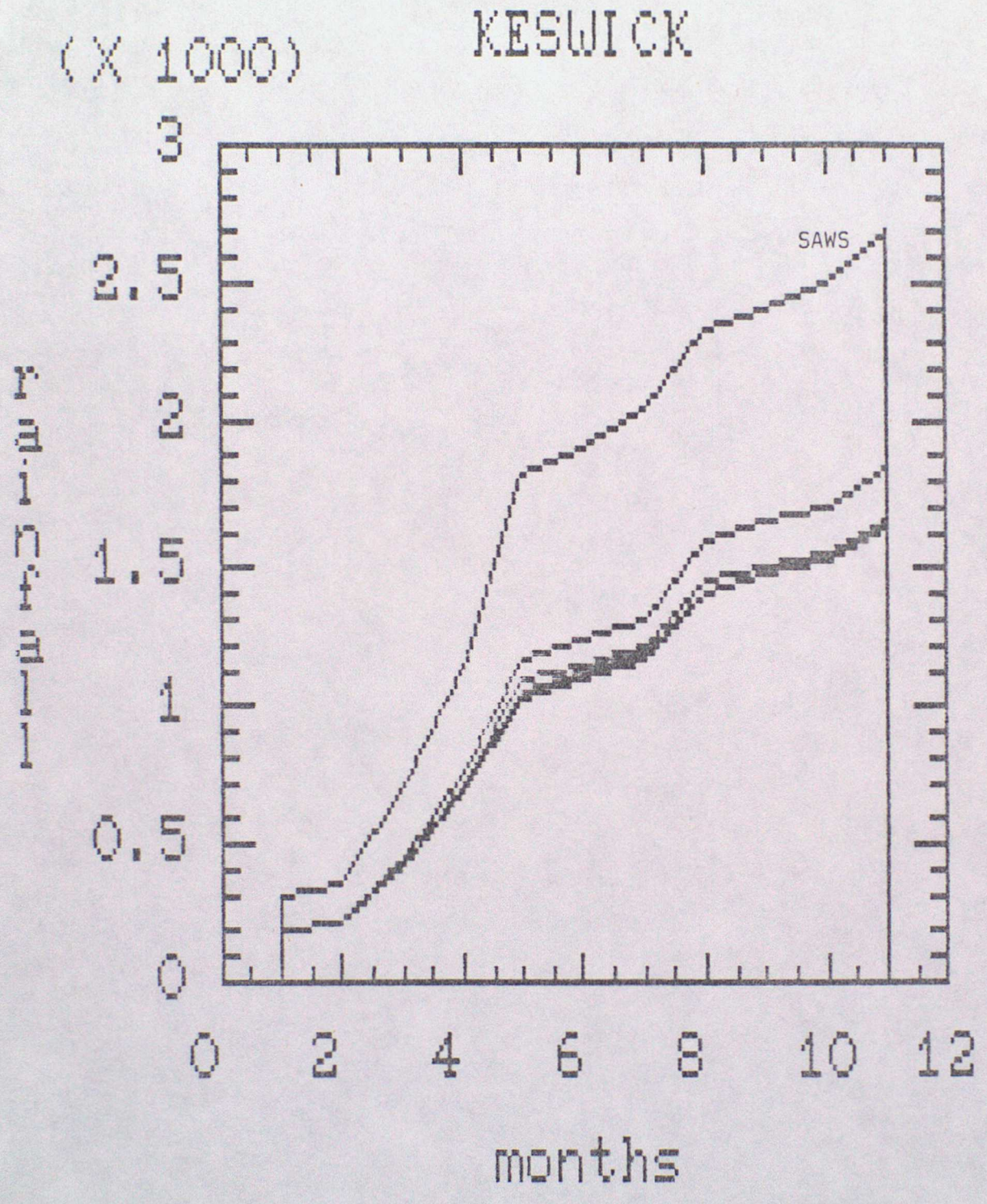
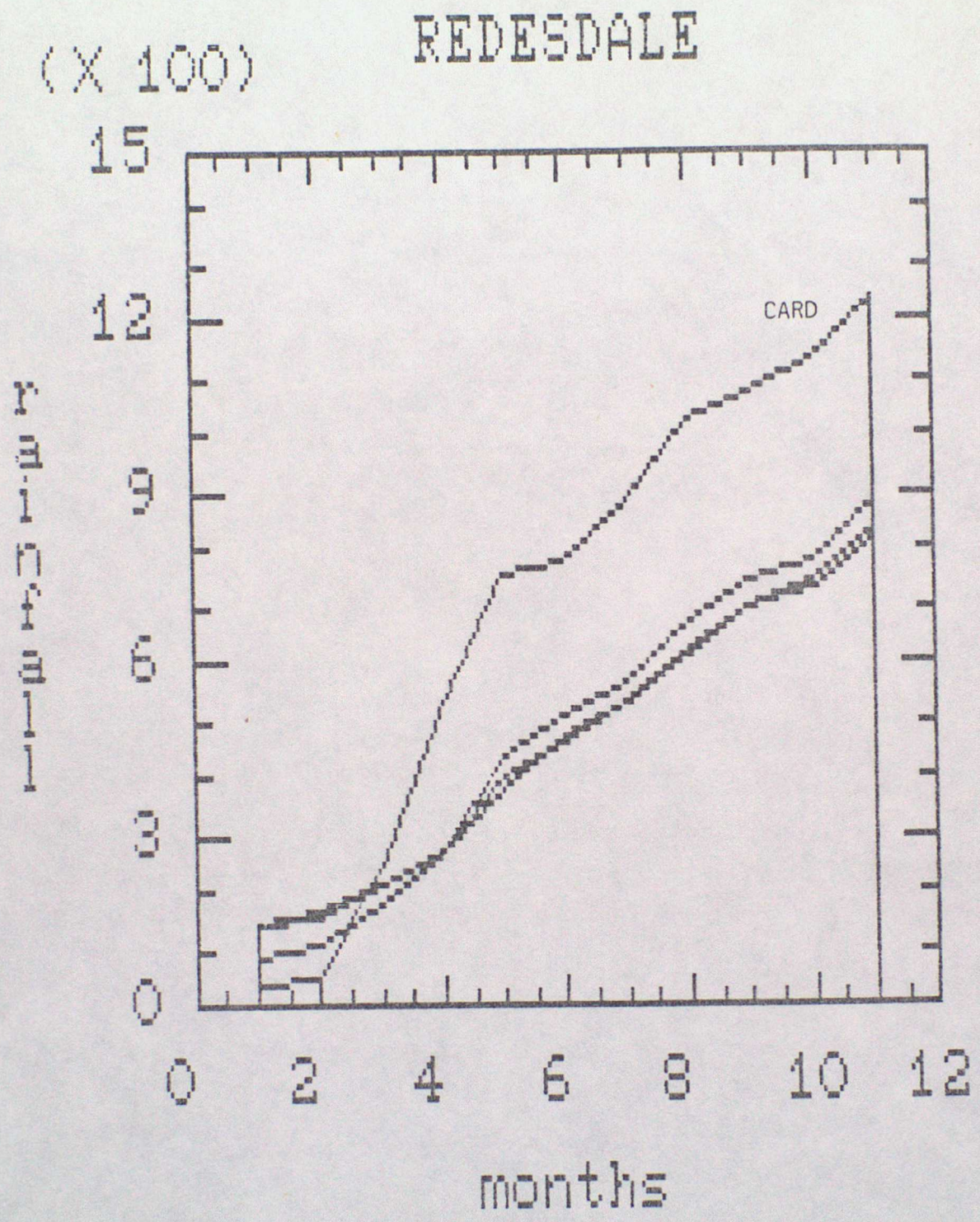
FIG 1



Accumulated rainfall totals for Keswick SAWS and four nearby gauges. Month 1 is August 1986 and month 11 is June 1987.

FIG 2



Accumulated rainfall totals for Redesdale CARD and three nearby gauges. Month 1 is August 1986 and month 11 is June 1987.

FIG. 3

SAWS	593351	592717	593525
4.0	0.0	3.4	1.5
25.0	16.2	16.8	17.5
84.0	27.0	40.1	54.5
82.0	51.3	56.7	47.2
4.0	0.6	1.8	2.2
0.0	2.1	1.9	0.1
28.0	16.3	28.6	21.9
46.0	19.8	10.6	17.0
0.8	0.0	0.0	0.8
27.4	8.2	13.5	23.8
24.0	5.6	7.4	6.6
37.4	18.4	25.7	18.7
3.0	0.5	0.7	0.7
22.0	19.9	27.3	25.9
41.0	9.0	8.4	12.9
13.0	8.7	6.8	9.1
28.0	13.9	12.2	17.6
18.0	11.3	11.3	12.4
10.8	6.6	6.6	8.0
0.0	0.0	0.0	0.0
0.8	0.5	0.0	0.0
0.0	0.0	0.0	0.0
0.4	0.0	0.0	0.0
22.0	10.7	9.5	16.2
0.0	1.2	1.8	1.4
14.0	2.8	6.2	9.2
26.0	12.5	6.1	9.6
7.0	5.1	2.3	4.5
31.0	21.2	18.9	19.7
54.0	32.3	29.3	41.9
37.0	12.5	20.8	18.8
690.6	334.2	374.7	419.7

Comparison of daily data from the Keswick SAWS with that from nearby gauges for December 1986.

FIG. 4

CARD	011070	011706	011384
0.8	2.3	2.4	2.7
8.0	1.9	1.2	0.7
0.8	0.0	0.0	0.0
0.0	1.9	0.6	0.6
4.0	0.4	1.5	0.0
3.0	2.4	0.8	1.0
10.0	14.5	8.5	9.8
1.6	1.0	0.7	1.8
34.0	3.8	1.7	1.5
8.0	1.3	2.0	1.7
2.6	0.4	0.3	0.0
0.0	0.1	0.0	0.0
12.8	4.6	4.4	5.0
7.0	3.3	3.2	2.5
1.0	0.0	0.0	1.1
13.0	1.2	1.2	0.4
20.0	3.8	4.4	3.0
19.0	4.4	5.2	5.6
0.8	0.1	0.0	0.0
1.0	0.0	0.0	0.0
10.0	6.5	2.3	10.1
43.0	10.0	4.8	2.6
7.8	1.5	1.0	0.3
31.0	13.3	8.3	4.0
37.0	5.0	4.3	3.4
2.0	0.9	0.4	0.6
0.0	0.0	0.0	0.0
5.0	1.7	0.0	1.0
0.0	0.2	0.0	0.0
0.3	0.6	0.0	0.1
283.5	87.1	59.2	59.5

Comparison of daily data from the Redesdale CARD with that from nearby gauges for November 1986.

APPENDIX 1.

ANNUAL AVERAGES OF ALL GAUGES USED.

Site	Annual average (mm)
Keswick SAWS	(1450)
593351	(1400)
593521	(1575)
593525	(1700)
592717	(1520)
Redesdale CARD	(890)
011070	(940)
011706	(860)
011384	(890)
Leconfield SAWS	(630)
043681	621
041237	(650)
044703	(660)
Warcop SAWS	(1050)
598384	(900)
598690	(930)
598806	852
St. Bees SAWS	(1000)
592199	953
591877	1218

The averages given are for the period 1941-1970. Those values shown in brackets are estimated averages for stations that do not have data for the whole period 1941-1970.